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Feeding Corn to Beef Cows

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In many western cattle operations, forages have traditionally been considered the most practical feedstuffs for wintering beef cows. However, in certain situations, the nutrient content of standing or harvested forages may be inadequate to meet the nutritional requirements of the beef cow for maintenance, gestation, or lactation. The availability of standing or harvested forages also may be limited, especially during drought years and(or) severe winters when the cost of medium- to low-quality forages may reach $80 to $100 per ton.

Feeding corn grain may represent an economically viable alternative in each of these scenarios.

How much corn can I feed my cows?

The answer is simple...as much as you like. Cows will essentially consume all of the corn offered to them.

A more difficult question is, "how much corn **should** I feed my cows?" The answer to this question depends on your management objectives, the quantity and quality of the available forage, the nutritional status of the cows, and their stage of production.

Addition of corn to beef cow diets can be in one of two basic systems, supplementation and substitution. Each system has very different objectives and situations to which it should be applied.

Negative associative effects

Before discussing the differences between supplementation and substitution, an important concept needs to be described. Negative associative effects result from the changes in the rumen environment associated with the addition of a highly digestible carbohydrate source (starch, in this case) to a fiber-based diet.

In the rumen, highly digestible carbohydrates are fermented relatively rapidly and can cause a reduction in the rumen pH. Fibrolytic bacteria (those responsible for breaking down fiber) prefer more a neutral pH; thus, as the pH of the rumen becomes more acidic, fiber digestion and forage intake can be compromised. Forage utilization may be depressed by as much as 10 to 30% as the amount of corn in the diet increases.

Previous research would suggest that the addition of corn to a fiber-based diet at greater than 0.25% of body weight can result in depressed forage intake and fiber digestibility.

The effect of feeding corn on forage intake and digestibility may be dependent on the level of protein in the diet. In digestion studies, increasing energy in diets containing low levels of protein has decreased intake and digestibility of low-quality roughage; however, with higher levels of supplemental protein (greater than 120% of requirements), increasing energy typically has little effect on intake or digestibility of low-quality roughage. Since protein is generally among the most expensive diet ingredients, caution should be used when increasing protein levels above the animal's requirements.

Corn as a forage supplement

When forage availability is high but the quality of the forage is inadequate to meet the nutritional demands of the gestating beef cow, energy supplementation becomes

essential. Corn is generally the most economical source of supplemental energy for the cow herd. The primary objective of corn supplementation in this scenario is to increase the energy intake of the cow without sacrificing forage utilization. Supplemental corn will generally correct an energy deficiency; however, forage intake and fiber digestibility may be depressed if the level of grain becomes too great.

To maintain maximal forage utilization, corn should not be supplemented at more than 0.25% of body weight. This equates to 2.5 lb for a 1000-lb cow, 3 lb for a 1200-lb cow, and 3.5 lb for a 1400-lb cow. These recommendations are based on whole shelled corn.

Ear corn can be supplemented at slightly higher levels (because of reduced energy concentration associated with the cob): 2.75, 3.25, and 3.75 lb per day for 1000-, 1200-, and 1400-lb cows, respectively. Depending on forage quality and the stage of production and body condition of the cows, supplemental protein may also be required.

Corn as a forage substitute

In general, when standing or harvested forages are readily available and the quality is adequate to support the cow's nutrient demands, protein is the most beneficial supplemental nutrient. However, when the roughage supply is limited, unavailable, or simply too costly, corn may represent a more economical means to provide energy to the cow herd.

Generally corn costs more per ton than forages; however, corn contains more energy per ton than forage. Table 1 illustrates the amount of various hays that can be replaced by 1 lb of corn. Table 2 illustrates the amount that could be paid for different forms of corn in relation to the price of medium-quality hay. It is important to remember that these tables are calculated strictly from the total digestible nutrient (TDN) values for each feed.

When the level of corn in the diet increases, the digestibility of the forage declines. This becomes critical when formulating diets. Calculation of energy intake without correction for negative associative effects may result in over- or under-estimation of total energy intake.

Supplementation of excess protein from a highly degradable source may help reduce or even eliminate these negative responses. However, protein is one of the most expensive nutrients to supplement, and increasing protein levels could add significant cost. Supplemental urea may be fed to cows in this situation, but levels should be kept at or below 0.1 lb per day. If the urea is fed together with a high-protein natural supplement (greater than 40% crude protein), urea should be fed at less than 10% of the protein equivalent.

There is no easy answer to what the levels of corn and protein should be in wintering diets. Many factors such as forage quality and availability, the cost of corn, the cost of protein, facilities, and managerial abilities should all be considered when deciding the best protocol.

Table 1. Amount of forage that can be replaced by one lb corn.[a]

Grain	Alfalfa Hay (60% TDN[b])	Brome Hay (56% TDN)	Sorghum-Sudan Hay (56% TDN)	Prairie Hay (48% TDN)
Ear Corn (82% TDN)	1.4	1.5	1.5	1.7
Cracked Corn (91% TDN)	1.5	1.6	1.6	1.9
Whole Shelled Corn (88% TDN)	1.5	1.6	1.6	1.8

[a]Values are based on tabular TDN estimates in the Nutrient Requirements of Beef Cattle, Seventh Edition, National Research Council, 1996.

[b]Total digestible nutrients.

Table 2. Comparative value of medium-quality hay (53% TDN[a]) and grain for wintering cows.[b]

Hay ($/ton)	Value of grain per cwt: Ear corn (82% TDN)	Cracked corn (91% TDN)	Whole shelled corn (88% TDN)
40	3.09	3.43	3.32
50	3.87	4.29	4.15
60	4.64	5.15	4.98
70	5.42	6.01	5.81
80	6.19	6.87	6.64
90	6.96	7.73	7.47
100	7.74	8.58	8.30
110	8.51	9.44	9.13
120	9.28	10.30	9.96

[a]Total digestible nutrients.

[b]Values are based on tabular TDN estimates in the Nutrient Requirements of Beef Cattle, Seventh Edition, National Research Council, 1996.

Limit-fed corn diets

An alternate feeding strategy that could offer significant cost savings when the availability of standing or harvested forage is limited is to offer a limit-fed high-concentrate diet. Limit-feeding is a more intensive form of substitution. The major objective of this feeding strategy is to provide enough energy and protein to support maintenance or reach a desired level of weight gain.

While this feeding strategy initially sounds enticing, there are some issues that must be considered. Adoption of this system may be limited to producers with the management skills, facilities, and ability to supply additional labor. Given the high level of concentrate in the diet, more management is required to ensure consistent feed intake and to watch for signs of digestive disturbances. Erratic feed consumption could have many negative consequences including acidosis, bloat, and reproductive failure.

Producers should also have adequate animal holding facilities (drylot or sacrifice pasture) and the ability to store and deliver feed. And strong fencing: With the dramatic reduction in feed intake cattle may appear gaunt and behave as if they are hungry. If the fencing around the holding area is inadequate, this behavior may become a problem.

It is important to resist the temptation to provide additional feed to these animals. Increasing the level of feed above what is required to meet the nutrient demands of the cow could eliminate potential cost savings and cause the cows to become too fleshy.

Finally, in order to prevent feed wastage, the diet should be offered in a bunk. Adequate bunk space is also a vital component to maintaining uniform feed consumption. Most guidelines for mature beef cows suggest between 24 and 30 inches of bunk space per head.

Previously, limit-fed high-grain diets have been used in growing systems for backgrounding cattle. Only recently has the strategy been investigated in gestating beef cows. Ohio State University researchers compared the performance of cows fed 11 lb of whole shelled corn, 2.6 lb of a pelleted supplement, and 2.2 lb of first-cutting orchardgrass hay (75% NDF, 10.2% CP) from November to April to the performance of cows fed hay free choice. In two of three trials, cows that were fed hay lost more body condition than cows that were limit-fed corn. Overall, cow performance was similar between feeding strategies. Calf birth weights were higher when corn was fed; however, there was no effect on calving difficulty. Calf weaning weights and cow conception rates also tended to be greater in the limit-fed groups.

Assuming that corn was priced at $2/bushel, the breakeven price for hay would be $44/ton. Said another way, if hay could not be purchased for less than $44/ton, limit-feeding a high-corn diet would be economically feasible. Furthermore, the authors calculated that for every $0.20/bu increase in the price of corn, the breakeven price for hay would increase by approximately $2/ton.

In other trials, monensin supplementation numerically increased cow weight gain, even when heifers were fed 7.5% less feed. The authors reported no negative effects on performance but did observe behavioral signs of hunger in the cows fed the high-corn diet. While the optimal hay intake for cows fed a high-concentrate diet has not been determined, it would be reasonable to assume that increasing the level of hay in the diet would improve the contentment of the cows, albeit at an increased cost.

Research from the University of Illinois examined the influence of corn processing on the digestion of limit-fed diets. Cow-calf pairs were fed either free choice alfalfa hay or were limit-fed diets containing either whole corn or cracked corn and alfalfa. Dry matter and organic matter digestibility were greater in the cattle that received processed corn than in those that received whole corn. Cow and calf performance were not different between cattle that were limit-fed corn-hay diets containing either whole or cracked corn or free choice hay.

Based on these experiments, corn-based diets fed at restricted intakes may be effectively used to meet the nutritional demands of gestating beef cows. Limit feeding corn appears to be a nutritionally and economically viable alternative to hay during winter months.

Delivery methods

The effectiveness of supplementation programs depends on the ability to achieve appropriate intake levels and minimize variation in intake. If cattle consume less than the desired intake, nutrient requirements may not be met. Conversely, if consumption is too high, supplement cost increases, forage intake and digestibility may decline, and cattle may become too fleshy or develop digestive disturbances (i.e. bloat or acidosis). Researchers from Montana State University suggest that the proportion of animals not consuming supplement is increased by limited trough space, small supplement

allowances, self-fed supplements, neophobia to feed, or feed delivery equipment. On the other hand, variation in individual animal consumption is increased by excessive trough space, limited supplement allowance, limit-fed supplements, neophobia to feed, feed delivery equipment, and individual feeding. Careful consideration to the space allowed for each animal and the amount of supplement offered may be an important component to effective supplementation

Several options, with a wide variety in cost and effectiveness, exist for delivery of supplement. In many range settings, supplements are provided directly on the ground. This feeding method can be cost effective; however, feed wastage, especially with small particle size feeds, may be a concern even on frozen ground. Providing the supplement in a bunk or in tires will reduce the amount of wastage.

Adequate space must be provided for each animal when using either bunks or tires; otherwise, feed intakes may be extremely inconsistent and lead to a multitude of problems. Many feed manufacturers sell high energy cakes or have the capability to make cakes from cereal grains. Depending on cost, including high-energy feeds in a range cake may be the best option for many ranchers.

Review

Using corn as a supplement to or replacement for hay is an economically viable means with which to increase the energy intake of the cow herd. Effective development of the optimum feeding strategy requires careful evaluation of the underlying objectives of adding corn to the diet.

Blind supplementation of corn to high-forage diets without consideration of forage quality and quantity, prices of corn and protein sources, and various management factors could result in increased feed costs for beef producers. Dynamic supplementation and substitution strategies could be formulated and adapted to fit into an infinite number of production scenarios.

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